

THAT WHICH IS CLAIMED:

1. A tubular medical set for the transfer of blood, said set having main blood flow tubing and a flexible branch tube connected in branching relation to the main tubing for connection to a source of physiological, cell free solution and for retaining a blood-solution interface, a portion of said branch tube being substantially flattened, whereby said tube portion has a lumen that can reduce its cross-sectional area responsive to negative pressure in said area, to suppress negative pressure pulses tending to disrupt said blood-solution interface, while said tube portion can increase its cross sectional area responsive to positive pressure in said area to facilitate solution flow therethrough.

2. The tubular set of Claim 1, in which said flattened branch tube portion comprises a flattened lumen cross section that defines a periphery having at least one open groove transverse to the cross section to avoid complete closing of said branch tube under negative pressure.

3. The tubular set of Claim 2 in which said flexible branch tube is of generally cylindrical shape, said tube being flattened at said tube portion by a slide clamp comprising a pair of arms defining a slot between them, said tube portion residing in said slot, at least one of said arms defining a transversely extending groove that forms said open groove in said tube portion.

4. The tubular set of Claim 1 in which said flexible branch tube is of generally cylindrical shape, said tube being flattened at said tube portion by a slide clamp comprising a pair of arms defining a slot between them, said tube portion residing in said slot.

5. A tubular medical set for the transfer of blood, said set having main blood flow tubing and a flexible branch tube connected in branching relation to the main tubing for connection to a source of physiological, cell free solution and for retaining a blood-solution interface, said set further comprising a device to suppress pressure pulses tending to disrupt said blood-solution interface in said branch tube while allowing the transfer of pressure across said pressure pulse suppression device at essentially all times and permitting at any time the relatively unrestricted flow of said cell free solution through said branch tubing to the main blood flow tubing.

6. The tubular medical set of claim 5 in which said device for suppressing pressure pulses comprises a moveable member that moves freely through a range of positions and partially occludes fluid flow in at least one of said positions.

7. The tubular medical set of claim 6 in which said moveable member comprises a ball.

8. The tubular medical set of claim 5 in which said device for suppressing pressure pulses comprises a duckbill valve having an imperfection causing the valve to permit large volume flow in one direction from the branch tube to the main blood flow tubing, and a smaller volume of flow in the opposite direction.

9. The tubular medical set of claim 5 in which said pulse suppression device comprises a moveable member having a central, reduced-width portion bracketed by increased-width portions for partial sealing, said moveable member being positioned in an in-line flow chamber in the flexible branch tube, said flow chamber defining an inwardly extending constriction which extends to retain said central, reduced-width portion of the moveable member, to permit the moveable member to reciprocate back and forth so that one enlarged width portion or another enlarged width portion engages said constricted portion of the chamber so that bidirectional flow is permitted, the enlarged width portions being shaped whereby the flow in one direction is greater in magnitude than the flow in the other direction under conditions of use, said one direction being from the branch tube to the main blood flow tubing.

10. The tubular medical set of claim 5 in which said device to suppress pressure pulses is designed to permit fluid flow in the direction opposed to the relatively unrestricted flow of said cell free solution in an amount of one to fifty percent of the magnitude of said relatively unrestricted flow at maximum rate, under conditions of normal use.

11. The method of imposing an oscillatory pressure upon the flow lumens of a tubular medical set having main blood flow tubing and a connected flexible branch tube, which comprises the step of partially occluding oscillatory fluid flow through said flexible branch tube to preserve a discrete interface between a portion of blood in said tubing and a portion of cell-free solution, and comprising the further step of thereafter providing immediate, substantially free flow of cell-free solution through said branch tubing into said main blood tubing.

12. The method of claim 11 in which said pressure of said oscillatory fluid flow is subatmospheric throughout its range.

13. The tubular medical set of claim 5 in which said device to suppress pressure pulses comprises a flattened portion of said branch tube comprising a flattened lumen cross section, said
5 tubing being flattened at said portion by a slide clamp comprising a pair of arms defining a slot between them, said tube portion residing in said slot, at least one of said arms defining a transversely extending groove that forms an open groove in the tube portion to avoid complete closing of said branch tube under negative pressure.

14. A tubular medical set for the transfer of blood, said set having main blood flow
10 tubing and a flexible branch tube connected in branching relation to the main tubing for connection to a source of physiological, cell-free solution and for retaining a blood-solution interface, said set further comprising a device to suppress pressure pulses tending to disrupt said blood-solution interface in said branch tube while allowing the transfer of pressure across said
15 pressure pulse suppression means at essentially all times and permitting at any time the relatively unrestricted flow of said cell free solution through said branch tubing to the main blood flow tubing, said device to suppress pressure pulses comprising a moveable member that freely, by action of flowing fluid, moves through a range of positions, said device to suppress pressure pulses being designed to permit fluid flow in the direction opposed to said relatively unrestricted flow of said cell free solution in an amount 1 to 50 percent of the magnitude of said relatively
20 unrestricted flow at maximum rate, under conditions of normal use.

15. The tubular medical set of claim 14 in which said moveable member comprises a ball.

16. The tubular medical set of claim 14 in which said device to suppress pressure pulses comprises a duckbill valve having an imperfection, causing the valve to permit large
25 volume flow in one direction from the branch tube to the main blood flow tubing and a smaller volume of flow in the opposite direction.

17. The tubular medical set of claim 14 in which said pressure pulse suppression means comprises a moveable member having a central, reduced-width portion bracketed by increased-width portions for partial sealing, said moveable member being positioned in an in-line
30 flow chamber in the flexible branch tube, said flow chamber defining an inwardly extending

constriction which extends to retain said central, reduced-width portion of the moveable member, to permit said moveable member to reciprocate back and forth relative to said constriction so that one enlarged width portion or another enlarged width portion engages said constricted portion of the chamber so that bidirectional flow is permitted, the enlarged width portions being shaped whereby flow of liquid through said constricted portion in one direction is greater in magnitude than the liquid flow in the other direction under conditions of use, said one direction being from the branch tube to the main blood flow tubing.

18. The tubular medical set of claim 17 in which the increased-width portion pointing away from the main blood flow tubing defines a second dimension of width that is no more than about half a first dimension of width, to facilitate liquid flow.

19. The tubular medical set of claim 5 in which said flexible branch tube has an inner diameter of no more than 4.5mm.

20. A tubular set having main blood flow tubing, a connected, flexible branch tube, and a flow restriction device to suppress pressure pulses, said device being positioned to control flow through said branch tube, said flow restriction device permitting substantially free, unhindered flow from the branch tube to the main blood flow tubing, while significantly restricting, but not completely blocking, flow from said main blood flow tubing to the branch tube.

21. The tubular medical set of claim 20 in which said flow restriction device comprises a moveable member that freely moves through a range of positions, and partly includes fluid flow in at least one of said positions, while allowing free flow in other of said positions.

22. The tubular medical set of claim 20 in which said moveable member comprises a ball.

23. The tubular medical set of claim 20 in which said moveable member has a central, reduced-width portion bracketed by increased-width portions for partial sealing, said moveable member positioned in an in-line flow chamber in the flexible branch tube, said flow chamber defining an inwardly extending constriction which extends to retain said central, reduced-width portion of the moveable member, to permit the moveable member to reciprocate back and forth so that one enlarged width portion or another enlarged width portion engages said constricted portion of the chamber so that bidirectional flow is permitted, the enlarged width portions being

shaped whereby the flow in one direction is greater in magnitude than the flow in the other direction under conditions of use, said one direction being from the branch tube to the main blood flow tubing.

24. The tubular medical set of claim 20 in which said flow restriction device
5 comprises a duck bill valve having an imperfection whereby the valve permits large volume flow in one direction from the branch tube to the main blood flow tubing, and allows a smaller volume of flow in the opposite direction.

25. The tubular medical set of claim 20 in which said flow restriction device permits
10 fluid flow from the main blood flow tubing to the branch tube which is an amount of one to fifty percent of the magnitude of flow in the opposite direction at maximum rate, under conditions of normal use.

26. The tubular set of claim 20 in which a pressure sensing device is connected to said flexible branch tube.

27. The tubular medical set of claim 20 in which said flexible branch tube has an inner
15 diameter of no more than 4.5 mm.